



AB5000™ System Console	S/N
AB5000™ AB Cart OR iPulse Cart	S/N
Hand Pump	S/N
Time Meter	Hrs.
Date	
Tested By	

All service and maintenance, which involves disassembly of the AB5000™ Console, must be performed by factory trained and certified service personnel. Replacement parts obtained from sources other than ABIOMED/IMPELLA must not be used. Possible Electrostatic discharge precautions must be observed. Prior to servicing, check with ABIOMED/IMPELLA technical support (USA 800-422-8666) (EUROPE +49-241 8860301) for available FCN releases and Service Manual updates.

#### **REQUIRED EQUIPMENT**

Item	Specification (or ABIOMED P/N for Specialized Tools)
Angled mirror	Miltex Mirror P/N 67-696/3 and Mirror Handle P/N 011-26641 or equivalent
Lint free swab with 6" plastic handle	Abiomed PN 7000-0030 (Lint free swab with 6" plastic handle) or equivalent
Hydraulic Load Simulator	ABIOMED/IMPELLA P/N 0005-0070
Digital Voltmeter	Fluke 77 or Equivalent
Laptop Computer	Running Windows 2000 or Later, Serial Port
Diagnostic Download Cable	ABIOMED/IMPELLA P/N 0015-9612
Pump ID Connector	ABIOMED/IMPELLA P/N 0055-0737
Pressure/Vacuum Gauge	-200mmHg to +500mmHg min (Damping set to 1 sec.)
Safety Analyzer (EUROPE ONLY)	IEC601-1 Tester

#### **[ ] 1. DECONTAMINATION**

Prior to servicing, the AB5000™ Console must be decontaminated. Unless otherwise known, the Console should be considered contaminated and universal safety precautions are to be taken. Gloves, masks, eye protection, and protective garments are to be worn as required in the handling and decontamination of the Console.

#### **[ ] 2. UNCRATING**

Uncrate the Console and Cart. Place the Hand Pump into the mounting bracket as required.

#### **[ ] 3. EXTERNAL INSPECTION**

Perform a thorough exterior inspection of the Console and Cart. Inspect for:

[ ] Turret rotation, panel damage, mechanical damage and any loose hardware.

#### **[ ] 4. INTERNAL INSPECTION**

Remove Console from Cart. Remove the Console panels. Perform a thorough interior visual inspection. (Inspect fittings, tubings, quick-connect tubing (insertion depth), cable connections, hardware).

[ ] Perform a general inspection of the compressor subassemblies, including but not restricted to, black debris in the rear bearing, tubing wear, mesh wear and electrical connections as per procedure 0015-7007.

#### **[ ] 5. PERFORM REQUIRED FIELD CHANGES (FCNS) – CONTACT ABIOMED FOR CURRENT FCN STATUS**

**[ ] 6. CHECK TIME METER HOURS. REPLACE PARTS AS REQUIRED PER MAINTENANCE SCHEDULE**

0015-3050 Humphrey® Valve Assembly	Every 5,000 Hours
0015-3000 Proportional Valve Assembly	Every 5,000 Hours
0015-3040 Compressor Assembly	Every 5,000 Hours
0015-3060 Battery Module Assembly	Every 2 Years
0015-3061P Battery Module Assembly A1	Every 2 Years
0015-7309 Perform PM Procedure	Annually

**[ ] 7. CONSOLE LUGGAGE HANDLE**

- [ ] Check Console's luggage handle for smooth operation. Verify proper latching in raised position.
- [ ] Check the console's luggage handle for chips, cracks, or signs of abuse. Replace if necessary.
- [ ] If available, check Bed Plate assembly for socket head cap crew, replace with flat countersunk head cap screw (PN 2850-5127).

**[ ] 8. HAND PUMP**

- [ ] Inspect the Hand Pump for any physical damage or loose hardware. Verify Piston Rod Handle is tight.

Move the left and right shuttle switches to BVS Pump mode.

- [ ] Verify shuttle pins engage securely into ball plungers.
- [ ] Cycle the Hand Pump Handle multiple times. Check for airflow at the left and right barbs.

Move the left and right shuttle switches to Ventricle Pump mode.

- [ ] Verify shuttle pins engage securely into ball plungers.
- [ ] Cycle the Hand Pump Handle multiple times. Check for airflow at the left and right barbs.
- [ ] Inspect Console's Hand Pump mount for any physical damage. Place the Hand Pump back into the mounting bracket.

**[ ] 9. POWER-UP SELF TEST SEQUENCE**

Plug the Console IN. Turn the Power Switch ON. Verify:

- [ ] All Keypad LED indicators illuminate and that the audible alarm sounds.
- [ ] An air pulse at the left barb, then an air pulse at the right barb.
- [ ] The self test ends within twenty (20) seconds and then the LCD displays the message "LEFT SYSTEM READY FOR USE" & "RIGHT SYSTEM READY FOR USE".

**[ ] 10. FAN CHECK**

- [ ] Verify the operation of the system cooling fan (access at the Diagnostic Access Panel).

**[ ] 11. POWER SUPPLY**

Setup: Console plugged in, batteries connected, console power on.

- [ ] Measure voltage output in the Power Supply assembly. Verify that voltage is  $32 \pm 0.1$  VDC.

**[ ] 12. BATTERY CHARGER**

Setup: Console plugged in, batteries connected, console power on.

- [ ] Measure charger voltage. Verify that charger voltage is between 26.6 – 27.6 VDC (this assumes that the batteries are fully charged).
- [ ] Disconnect battery connector.
- [ ] Measure charger voltage. Verify that the charger voltage is between 30-33 VDC
- [ ] Verify “BATTERY” LED is illuminated RED.
- [ ] Verify “BATTERY FAULT DO NOT UNPLUG” is displayed.
- [ ] Reconnect battery.

**[ ] 13. ALARM VOLUME TEST**

Press the Alarm Volume button. Verify:

- [ ] That the audible alarm sounds at three volume levels.

**[ ] 14. PUMPING CONTROLS**

Press the left “ON” button. Verify:

- [ ] The Console starts pumping and that the left “RATE” LED blinks amber.
- [ ] The left “ON” LED illuminates green.

Press the left “OFF” button once. Verify:

- [ ] The Console continues pumping and that the left “OFF” LED blinks red.
- [ ] The left “OFF” LED turns off in 10 - 14 seconds.

Press the left “OFF” button twice within 10 seconds. Verify:

- [ ] The Console stops pumping, the left “OFF” LED illuminates red, the left “ON” LED turns off, and the audible alarm turns off.
- [ ] Repeat the above test for the right side.
- [ ] While holding the left “ACTIVATE” button, press the left “STROKE” button. Verify that there is a single air pulse at the left barb.
- [ ] While holding the right “ACTIVATE” button, press the right “STROKE” button. Verify that there is a single air pulse at the right barb.

**[ ] 15. ALARM MUTE**

Generate an audible alarm. Press the Alarm Mute button. Verify:

- [ ] The audible alarm silences and that the Alarm Mute LED illuminates amber. At between 50 – 70 seconds the audible alarm starts to sound and the Alarm Mute LED turns off.

**[ ] 16. PUMP ID**

Power Console on open port. Verify:

- [ ] Display indicates BVS Pump Mode left and right sides.
- [ ] Connect Ventricle Pump connector to left drive port. Verify display indicates Ventricle Pump mode left side.
- [ ] Move Ventricle Pump connector to right drive port. Verify display indicates Ventricle Pump mode right side. Power Console down.

**[ ] 17. EMERGENCY SYSTEM OPERATION**

Activate the Emergency System Mode. Verify:

- [ ] "EMERGENCY SYSTEM ON" indicator illuminates within 15 seconds from power-up.
- [ ] The Console is pumping at 75 BPM.
- [ ] The LCD display is blanked.
- [ ] An audio alarm is sounded.
- [ ] The audio alarm is silenced when the "Mute" button is pressed.

**[ ] 18. ALARMS, PNEUMATIC**

With the left barb in the open port state, press the left "ON" button. Verify:

- [ ] At the beginning of the 5<sup>th</sup> beat the left side "LOW PRESSURE" alarm occurs.
- [ ] Within 9 beats the left side "LOW PRESSURE" & "LOW FLOW" alarms occur.

Press the left "OFF" button twice. Block the left barb then press the left "ON" button. Verify:

- [ ] Within 9 beats the left side "HIGH PRESSURE" & "LOW FLOW" alarms occur.

Press the left "OFF" button twice.

With the right barb in the open port state, press the right "ON" button. Verify:

- [ ] At the beginning of the 5<sup>th</sup> beat the right side "LOW PRESSURE" alarm occurs.
- [ ] Within 9 beats the right side "LOW PRESSURE" & "LOW FLOW" alarms occur.

Press the right "OFF" button twice. Block the right barb then press the right "ON" button. Verify:

- [ ] Within 9 beats the right side "HIGH PRESSURE" & "LOW FLOW" alarms occur.

Press the right "OFF" button twice.

**[ ] 19. ADJUSTABLE LOW FLOW ALARM (IF EQUIPPED)**

Connect Load Simulator to left output. Start pumping left side. Press "FUNC" key once to select Step Down screen. Press and hold the left Activate button. Use the "UP" button to set alarm limit to 2.5 L/min. Release "Activate" button. Verify:

- [ ] Low Flow alarm is indicated when displayed flow drops below 2.5 L/min.
- [ ] Repeat test for right side.

**[ ] 20. WEANING**

Connect the Hydraulic Load Simulator to the Console's left side. Start pumping in BVS mode. Allow flows to stabilize.

- [ ] Set the left side weaning to 2.0 L/min. Verify flow updates to 2.0 L/min.
- [ ] Exit weaning. Verify recovery back to full flow.
- [ ] Repeat test for Console's right side output.

Insert Ventricle Pump ID connector into Console's left Turret. Connect the Hydraulic Load Simulator to the Console's left side. Start pumping in Ventricle Pump mode. Allow flows to stabilize.

- [ ] Set the left side weaning to 2.0 L/min. Verify flow updates to 2.0 L/min.
- [ ] Exit weaning. Verify recovery back to full flow.
- [ ] Repeat test for Console's right side output.

**[ ] 21. COMPRESSOR SPEED CHECK**

With Console powered on and in diagnostic terminal mode, verify compressor speed.

- [ ] BVS Pump Mode: 1050 RPM +/-52
- [ ] Ventricle Pump Mode: 1300 RPM +/-65
- [ ] Emergency System Operation 1050 RPM +/-52

**[ ] 22. PRESSURE / VACUUM CHECK (PLENUM)**

With Console powered on and in diagnostic terminal mode, verify plenum pressures and vacuums.

	<b>BVS Mode Pressure (Pump ON)</b>	<b>BVS Mode Vacuum (Pump ON)</b>	<b>Ventricle Mode Pressure (Pump OFF)</b>	<b>Ventricle Mode Vacuum (Pump OFF)</b>
<b>Left</b>	320mmHg +/- 15	-35mmHg +/- 10	420mmHg +/-15	-100mmHg +/-10
<b>Right</b>	200mmHg +/-10	-35mmHg +/-10	300mmHg +/-10	-100mmHg +/-10

**NOTE:** Pressure Values to be measured as **Prs Plen Max**.

Vacuum Values to be measured as **Vac Plen Min**.

Ventricle ID Plug must be installed for Ventricle measurements.

**[ ] 23. PRESSURE / VACUUM CHECK (BARB)**

With Console powered on and using the Pressure Gauge, verify barb pressures and vacuums.

	<b>BVS Mode Pressure (Pump ON)</b>	<b>BVS Mode Vacuum (Pump ON)</b>	<b>Ventricle Mode Pressure (Pump ON)</b>	<b>Ventricle Mode Vacuum (Pump ON)</b>
<b>Left</b>	320mmHg +/- 15	-35mmHg +/- 10	420mmHg +/-15	-100mmHg +/-10
<b>Right</b>	200mmHg +/-10	-35mmHg +/-10	300mmHg +/-10	-100mmHg +/-10

**NOTE:** Ventricle ID Plug must be installed for Ventricle measurements.

**[ ] 24. TARE OFFSETS**

Connect diagnostic download cable between Computer and Console. Power Console on. Enter Diagnostic Terminal mode. Record initial tare offset values at '0 min (a)'.

If the tare value is outside of +/- 10.0 L/min, replace the flowmeter.

If the tare value is outside of +/- (3.0 – 10.0 L/min) , send the following commands to tare the flowmeter (items within <> indicate the key to press):

**<ENTER> <ENTER> \*@=A <ENTER> A\$\$V <ENTER>**

The tare offset should be reduced following the command. Repeat once more if it does not. Record the post-tare offset into 0(b).

If the tare value is within +/- 3.0 L/min, record the offset into 0 (a), record n/a into 0(b).

Record the tare offset in the following time intervals.

Time (min)	Left Alicat	Right Alicat	Acceptable Flow Out:	Pass √	Fail √
	Flow LPM	Flow LPM			
0 (a)			+/- ( 3.0 – 10.0 ) L/min	N/A	N/A
0 (b)			0.0 +/- 3.0 L/min		
2			T=2-T=0 < ±0.5 L/min		
4			T=4-T=2 < ±0.5 L/min		
6			T=6-T=4 < ±0.5 L/min		
8			T=8-T=6 < ±0.5 L/min		
10			T=10-T=8 < ±0.5 L/min		
12			T=12-T=10 < ±0.5 L/min		
14			T=14-T=0 < ±0.5 L/min		
16			T=16-T=14 < ±0.5 L/min		
18			T=18-T=16 < ±0.5 L/min		
20			T=20-T=18 < ±0.5 L/min		
22			T=22-T=20 < ±0.5 L/min		
24			T=24-T=22 < ±0.5 L/min		
26			T=26-T=24 < ±0.5 L/min		
28			T=28-T=26 < ±0.5 L/min		
30			T=30-T=16 < ±0.5 L/min		
	Specification: 0.0 +/- 3.0 L/min (excluding 0 (a))				

**[ ] 25. VACUUM ADJUST (IF EQUIPPED)**

Press Console “FUNC” key twice to select Vacuum Adjust screen. Verify:

- [ ] Left-side vacuum range is adjustable between -35 mmHg to -100 mmHg in 5 mmHg increments
- [ ] Right-side vacuum range is adjustable between -35 mmHg to -100 mmHg in 5 mmHg increments

Set and verify the following left-side and right-side vacuums:

Left	[ ]	-35 mmHg	Right	[ ]	-35 mmHg
	[ ]	-50 mm Hg		[ ]	-50 mm Hg
	[ ]	-75 mmHg		[ ]	-75 mmHg
	[ ]	-90 mmHg		[ ]	-90 mmHg

**[ ] 26. REMOTE ALARM (IF EQUIPPED)**

Plug a 2-conductor ¼” phone plug to the remote alarm jack. Connect a DVM between the plug contacts. Verify:

- [ ] Short circuit (Ohmic resistance of < 1 ohms) when alarm condition is active.
- [ ] Open circuit (Ohmic resistance more than 1M is acceptable) when no alarm is active.

**[ ] 27. STATUS INDICATORS**

Setup: Console is plugged in and powered on.

- [ ] When the console is plugged in and powered on, the following should be indicated:

Panel LEDs: “AC POWER” is GREEN

“CHARGING” may be AMBER or OFF

LCD Display: “FULL CHARGE” or “BATTERY CHARGING”

- [ ] Unplug the console while it is running. Plug it back in within ~10 seconds. The following should be indicated momentarily:

Panel LEDs: “AC POWER” is GREEN

“CHARGING” is AMBER

LCD Display: “BATTERY CHARGING”

- [ ] When the battery is fully charged (within 5 minutes), the following should be indicated:

Panel LEDs: “AC POWER” is GREEN

LCD Display: “FULL CHARGE”

**[ ] 28. BATTERY RUN**

Setup: Console fully charged, and plugged into an AC outlet. Ventricle Pump ID Connector plugged into left drive port. Console pumping Bivac open port.

- [ ] Unplug the console. The following should be indicated:

Panel LEDs: "BATTERY" LED is AMBER

LCD Display: "BATTERY IN USE"

- [ ] Verify two beep audio alarm every 60 seconds.
- [ ] Verify 60-minute battery run without a Battery "Low" or "Fault" condition.

**[ ] 29. CONSOLE CART**

- [ ] Inspect the Cart for any physical damage.
- [ ] Inspect castors for any damage. Check brake, directional locks and rotation.
- [ ] Check storage compartment door for proper operation and latching.
- [ ] Check Console-to-Cart latching mechanism for proper operation.

**[ ] 30. FINAL CHECK**

- [ ] Reinstall the Console panels. Perform a visual inspection to ensure that all hardware and connections have been completed.
- [ ] Place the Console onto the Cart.
- [ ] Remove the protective film from the LCD display.
- [ ] Perform the Power up Self Test.
- [ ] If a console installation is being performed, remove the temporary advisory label on the front panel.

**[ ] 31. ELECTRICAL SAFETY (EUROPE ONLY)**

- [ ] Earth Resistance: \_\_\_\_\_ mΩ (<200 mΩ)
- [ ] Insulation Resistance: \_\_\_\_\_ MΩ (>20 MΩ)
- [ ] Earth Leakage NC: \_\_\_\_\_ mA (<0.5 mA)
- [ ] Earth Leakage SFC: \_\_\_\_\_ mA (<1mA)
- [ ] Enclosure Leakage NC: \_\_\_\_\_ mA (<0.1mA)
- [ ] Enclosure Leakage SFC (Neutral Open); \_\_\_\_\_ mA (<0.5 mA)
- [ ] Enclosure Leakage SFC (Earth Open): \_\_\_\_\_ mA (0.5 mA)